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**Joint
Advanced
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Program**

Two Lectures:

Transformation and Innovation: The Lessons of the 1920s and 1930s

Looking at Two Distinct Periods of Military Innovation: 1872 – 1914 and 1920 – 1939

Williamson Murray

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This document contains written versions of two talks that military historian, Williamson Murray of the JAWP gave on military innovation. The first lecture was presented as part of the Chairman of the Joint Chiefs of Staff General Richard B. Myers Lecture series in December 2002. It identified the main drivers of transformation and innovation in the American military between the two World Wars. Lessons from that period are still applicable to the current efforts to transform the American military. Among the enablers this lecture emphasized were the intellectual effort required for successful innovation in peacetime and to the careful connecting of that intellectual effort to rigorous and honest experimentation.

The second paper (in annotated briefing form) also covers military innovation in this heavily researched 1920–1939 period and includes some of the same material. But it takes a broader look at military innovation in this period by examining the experiences of other nations as well. Additionally, the paper ventures into less explored territory by looking at another interwar period, 1872 to 1914, between the end of the Franco-Prussian War and the beginning of World War I. Dr. Murray suggests that the challenges of the earlier period may be more relevant to our own time. This paper was originally given at the US Marine Corps School of Advanced Warfighting at Quantico, Virginia, in October 2002.

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Preface

This paper was prepared under the task order Joint Advanced Warfighting Program (JAWP) for the Director, Defense Research and Engineering in the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics. It addresses the task order objective of producing breakthrough joint operational concepts.

JAWP was established at the Institute for Defense Analyses (IDA) by the Office of the Secretary of Defense and the Joint Staff to serve as a catalyst for stimulating innovation and breakthrough change. The JAWP Team is composed of military personnel on joint assignments from each Service and civilian research analysts from IDA. JAWP is located principally in Alexandria, Virginia, but includes an office in Norfolk, Virginia, that facilitates coordination with the United States Joint Forces Command.

This paper does not necessarily reflect the views of IDA or the sponsors of the JAWP. Our intent is to stimulate ideas, discussion, and, ultimately, the discovery and innovation that must fuel successful transformation.

Two Lectures.

Transformation and Innovation: The Lessons of the 1920s and 1930s

Looking at Two Distinct Periods of Military Innovation: 1872–1914 and 1920–1939

Transformation and Innovation:
The Lessons of the 1920s and 1930s

Prepared for the
Chairman of the Joint Chiefs of Staff
Lecture Series

Williamson Murray
December 2002

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Executive Summary

In the 1920s and 1930s, the individual services of the United States took different paths. The maritime services used war gaming and red teaming at the Naval War College to prepare for future conflict. One result was the creation of carrier doctrine, accomplished before the Navy had a single operational aircraft carrier. The Army (and Army Air Corps) also placed considerable emphasis on professional military education, but there was a less coherent focus on transformation, innovation, and the development of new capabilities. One exception was the infantry school at Fort Benning, Georgia, during the five years that George Marshall served as assistant commander. The Army Air Corps also placed considerable emphasis on its schools.

On the other hand, several obstacles to change existed, particularly for the Army and Army Air Corps. First, the Army's promotion system did nothing to encourage talented officers who could drive transformation. Second, the expanse of the United States tended to isolate Army posts from each other, making large-scale exercises difficult. Third, legislative and executive branch parsimony made it difficult for the Army to even maintain itself during peacetime. On a broader scale, the Army's theories of war in the air were largely not provable, at least until its forces were engaged in conflict.

Once war began, Army and Navy forces faced other difficulties. For the Army Air Forces, *doctrine* had become *dogma*—as a result, the same lessons had to be learned several times, at the cost of many lives. For both services, general overconfidence—arrogance in many cases—led to a tendency to underestimate potential opponents, with disastrous consequences. Even where overconfidence was not a factor in defeat, lack of preparedness was. Here, part of the blame must reside with Congress and the US presidents. Their general unwillingness to support serious military preparations until the last moment made it extraordinarily difficult to build tactical skills at the most basic levels.

Although small groups of officers in the armed services did much to transform the services, too much of the peacetime military was devoted to maintaining the status quo. The difficulties of transformation and innovation in the 1920s and 1930s suggest the difficulties of the paths ahead. There are no silver bullets, no simple solutions. Only hard, unrelenting, rigorous testing of concepts and doctrine and honest, serious intellectual effort can prepare America's military forces to meet the challenges of an uncertain and ambiguous future.

Introduction

It is indeed a great honor to have the opportunity to give the Chairman's lecture here in the Pentagon. My main theme is the transformation of the US military during the period between the two world wars. What I hope to do is examine the experiences of the past in light of what might be useful today.[1] Because this is an American audience, I will focus on the performance of the military institutions of the United States during this period—with some references to the experiences of others—even though my main academic interest has been with European military organizations.

Given the penurious approach of the American government's executive and legislative branches to the problems of national defense throughout this period, the record of the US military is far and away the most impressive of any nation in the 1920s and 1930s. Moreover, full-scale rearmament began very late for all the American services: for the US Navy in 1938, for the US Army Air Forces in September 1939, and for the US Army in summer 1940. Whereas the German Army had over six years to prepare for war, units of the US Army found themselves engaged in major combat operations in North Africa within two years and four months of the beginning of that service's rearmament efforts.[2]

The course of American efforts at transformation underline that it was the intangibles of *education*, *experimentation*, and *leadership* that mattered the most, and that technology and resources were only enablers.

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[1]   The intellectual basis of this lecture is largely the result of the work that my colleague, Professor Allan Millett of the Ohio State University and I undertook at the behest of Andrew Marshall, the Director of Net Assessment in the Department of Defense, in the early 1990s to examine how military organization innovated, or did not innovate, during this interwar period. For the results of that work, see Williamson Murray and Allan R. Millett, *Military Innovation in the Interwar Period* (Cambridge, MA, 1996).

[2]   The combat record of the US Army is often criticized when compared to that of the *Wehrmacht* during the Second World War. Such criticism largely fails to recognize a number of factors: the late date at which American rearmament efforts began; the extraordinary American record in logistics and intelligence in comparison to the Axis powers; and the steady improvement of the US Army's performance during the course of the war. For the foremost of these critiques, see Martin van Creveld, *Fighting Power: German and US Army Performance, 1939–1945* (Westport, CT, 1982).

The Problems of Transformation

The context of transformation suggests that a number of systemic problems always confront military institutions in addressing the processes of transformation and innovation. The foremost is the reality of an uncertain and ambiguous future: Against whom will they fight? Under what political and strategic conditions? Where will that struggle take place? What technological, doctrinal, and tactical changes will have the greatest impact on the battlefield?

For the most part, military institutions rarely study the last war

To add to these difficulties, military institutions must innovate and transform by developing concepts and doctrine that they can rarely replicate in peacetime.[3] Moreover, the bureaucratic, day-to-day processes involved in running peacetime military organizations serve to distract military leaders from the problems of preparing for war at some uncertain date. No matter how farsighted military leaders may be, they will always get a portion of the equation wrong. The issue, then, is to get it less wrong than future opponents and then to adapt more quickly than the enemy does.

Military leaders and their organizations also confront the problem of making difficult judgments on the basis of *incomplete information*—incomplete information often reinforced by *faulty assumptions*. Historians have argued that because militaries study the last war, they do badly in the next. The historical record indicates that such a picture is largely wrong. For the most part, military institutions rarely study the last war, and even when they do, they have a tendency to examine only what agrees with their inclinations, preconceived notions, and prejudices.

Ironically, there were only two major efforts to examine the lessons of the First World War—the first by the Germans and the second by General Pershing's Allied Expeditionary Force headquarters. In the former case the chief of the German Gen-

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[3] Michael Howard has suggested that these difficulties might best be compared to those a surgeon might confront were he to be asked to cease carrying out operations on real human beings, and instead prepare himself over a twenty- or thirty-year period by reading books and practicing on rubber dummies before resuming his practice. In such a case, we would not be surprised at the results. See Michael Howard, "The Uses and Abuses of Military History," *Journal of the Royal United Services Institute,* 1973.

eral Staff, General Hans von Seeckt, established no less than fifty-seven different committees to study the lessons of World War I.[4] His instructions were explicit:

> [He wanted] short, concise studies on the newly gained experiences of the war and [to] consider the following points: a) What new situations arose in the war that had not been considered before the war? b) How effective were our prewar views in dealing with the above situations? c) What new guidelines have been developed from the use of new weaponry in the war? d) Which new problems put forward by the war have not yet found a solution?[5]

The result of these studies was an intellectual framework that eventually resulted in a revolutionary combined-arms doctrine that came close to destroying Western Civilization in the early years of World War II. It is only through a sense of what has happened in the past that military organizations can gain a glimmering of reasonable paths to the future. After all, as the old saw goes: "If you don't know where you've been, any road will do."

There is, admittedly, a considerable difficulty in using the past as a guide. Historians tend to simplify the complex course of events. Working their way back from some extraordinary event, such as the German breakthrough on the Meuse in May 1940 or the Battle of Midway, historians find it easy to underline the decisions and causes that contributed to success or failure.[6] What they often leave out are the uncertainties and ambiguities, the arguments and accidents that make decision making such an extraordinarily difficult affair. We in the twenty-first century know the results of policy and doctrinal debates in the 1920s and 1930s. Those at the time did not; there were always other roads to the future that were not taken, sometimes for the most obscure of reasons. The past is always an uncertain guide to the future, but it is the only one that we have.

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[4] The Germans were not at all interested in studying the strategic lessons of the First World War, but instead managed to repeat virtually every mistake made in the Second World War. For an examination of this phenomenon, see Williamson Murray, *German Military Effectiveness* (Baltimore, MD, 1992), chap. 1.

[5] Quoted in James S. Corum, *The Roots of Blitzkrieg, Hans von Seeckt and German Military Reform* (Lawrence, KS, 1992), p. 37.

[6] For a discussion of the ambiguities and uncertainties of decision making even in the most successful of military campaigns, see Williamson Murray, "May 1940: Contingency and Fragility of the German RMA," in *The Dynamics of Military Revolution, 1300–2050*, edited by MacGregor Knox and Williamson Murray (Cambridge, 2001).

The Strategic and Contextual Framework for Change

Perhaps the greatest difference between the interwar period and the present is that the First World War suggested most of the directions toward which military capabilities and technology were pointing in the 1920s and 1930s.[7] Virtually all of the major changes in military capabilities that reached full flower in World War II had begun to emerge at the end of the Great War: combined-arms tactics, submarine war, strategic bombing, and even carrier warfare had all appeared in nascent form by November 1918.[8] While the possibilities and enablers were unclear to victors and vanquished alike, the battles of 1918 had at least suggested the possible vectors for change to military leaders in the postwar period.

Unlike our present era, the military institutions of the interwar period confronted distinct military challenges

Unlike our present era, the military institutions of the interwar period confronted distinct military challenges. For the Germans, the challenge was a deep desire to overthrow the Treaty of Versailles and achieve the hegemony in Europe they had come so close to attaining in World War I. In the 1920s, given the limitations on armaments imposed by the Treaty of Versailles, they had to think in terms of defending their borders against the superior forces of the French and their Eastern European allies. That led to a considerable interest in *mobility* as a means to augment the *Reichswehr*'s (German military's) fighting power.[9] In the long run the Germans were aiming at achieving the ability to wage a war of aggression.

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[7]   This was not the case in the period before the First World War from 1871 to 1914, when the industrial revolution had a truly massive impact not only on military capabilities but on the very social and economic fabric of European and American societies—a revolutionary state of affairs, the implications of which were clear to no one. For an examination of the difficulties that the German military had in coping with the impact of the Industrial Revolution on their concepts of war, see Eric Dorn Brose, *The Kaiser's Army, The Politics of Military Technology in Germany During the Machine Age, 1870–1918* (Oxford, 2001). For the connection between social and economic revolutions and revolutions in military affairs in history, including the Industrial Revolution, see Knox and Murray, *The Dynamics of Military Revolution.*

[8]   The only possible revolution in military affairs that did not appear was airborne warfare, although the American airman, Billy Mitchell, did suggest the use of paratroopers to attack German airdromes in 1919. The end of the war prevented such employment.

[9]   As early as 1922 the Germans were experimenting with using mobility to augment their combat power. General von Seeckt reported on these maneuvers in the following terms: "I fully approve of the Harz exercise's conception and leadership, but there is still much that is not clear about the

The 1920s resulted in creation of a tactical and operational framework based on a thorough and accurate reading of the last war's lessons. Given the context of German strategic aims, that tactical framework emphasized the conduct of offensive, aggressive operations. The massive rearmament programs of the Nazi regime then fleshed out the doctrinal and conceptual framework and created the terrifying military instrument that destroyed the European balance of power in 1940.[10] The great weakness in the German effort in the Second World War, however, rested on the fact that the Germans prepared their military forces to fight and win a war in Central Europe and not on a worldwide scale. Thus, when they found themselves waging war from the plains of Russia to the North Atlantic and from the Arctic wastes of the North Cape to the deserts of North Africa, they possessed neither the logistic nor the intelligence support required to fight war on a global scale.[11]

The American military prepared for war within a framework determined by the strategic and political realities of America's peculiar situation as a great power, separated from potential battlefields by two great oceans. For the Navy and the Marine Corps the obvious opponent was Imperial Japan. From the early 1920s on, they began gaming and thinking about the strategic, operational, and logistic problems that might arise in a conflict in the Pacific.

The Germans possessed neither the logistic nor the intelligence support required to fight war on a global scale

The Army also focused on the problem of projecting American military power across oceanic distances. Unlike their brethren in the Navy and Marine Corps, who largely focused on the Pacific, many in the Army felt the Germans would make another run at dominating Europe. They felt that the United States would inevitably become involved again in Europe. With such beliefs, officers stood in stark contrast to the majority of their countrymen, who believed that the United States would never again be involved in a foreign war.

The story of the Army Air Corps, ancestor of the current US Air Force, was rather different. For a variety of reasons, it developed its concepts with no specific oppo-

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specific tactical use of motor vehicles. I therefore order that the following report be made available by all staffs and independent commands as a topic for lectures and study." Reichswehrministerium, Chef der Heeresleitung, Betr: "Harzübung, 8.1.22," National Archives and Records Administration, Captured German Records, T-79/65/000622.

[10] Until the early 1980s, many historians based their analysis of German rearmament almost entirely on the efforts of the 1930s. That view has been almost entirely overthrown and replaced with an understanding of the contribution made in the 1920s.

[11] This is a major theme in two histories: Gerhard Weinberg, *A World at Arms: A Global History of World War II* (Cambridge, 1995), and Williamson Murray and Allan R. Millett, *A War to Be Won, Fighting the Second World War* (Cambridge, MA, 2001).

nent, or set of opponents, in mind. In effect, Air Corps officers developed heavily theoretical, generic conceptions of future war. There were a number of reasons for this. First, most airmen rejected the lessons of past war as being irrelevant to future warfare.[12] Second, the rapid development of technology led many to believe that there was no tactical or operational problem that technology could not solve in the near future. Moreover, the sheer distances to Europe and Japan and the capabilities available, even in the late 1930s, made it difficult to envision a specific enemy. The result was the creation of *generic opponents* in the articulation of air doctrine—generic opponents against whom the capabilities under development would work. This led to the development of the concept of precision, high-altitude bombing, which would, it was argued, confront no serious air defense and against which the enemy could not adapt.

The focus on generic opponents allowed the US Army Air Corps to ignore, to a considerable extent the contributions air power could make to the joint battle. (On the other hand, since the *Luftwaffe*'s approach rested on a close analysis of the last war, it is not surprising the Germans developed close-air support, reconnaissance, airborne, and interdiction capabilities in addition to strategic bombing capabilities.[13]) Focusing on generic opponents also led to considerable mirror imaging on the part of the Americans. Thus, in developing theories of attacking the enemy's industrial web through high-altitude precision bombing, American airmen used their nation's economy as their model for examining the possibilities open to what today would be called *effects-based operations*.[14] Unfortunately, the American economy had entirely different weaknesses and strengths than the German economy, and that reality had a profoundly negative impact on America's conduct of the strategic bombing offensive over Europe in 1943.

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[12]   Clausewitz explicitly warns that theory must be closely connected to the real world of historical experience. Carl von Clausewitz, *On War*, edited by Michael Howard and Peter Paret (Princeton, NJ, 1975).

[13]   The myth that the *Luftwaffe* had no interest in strategic bombing capabilities has been disproved by German and American historians. In fact, in 1940 the Germans possessed strategic bombing capabilities, including blind bombing, far in advance of any other air force in the world—capabilities that the Royal Air Force (RAF) and the US Army Air Forces would not be able to match until 1942. For a discussion of the *Luftwaffe*'s prewar development, see Williamson Murray, *Luftwaffe* (Baltimore, MD, 1985), chap. 1.

[14]   This approach would have a negative impact on the American conception of how to go about attacking the German economy in 1942 and 1943.

Innovation and Professional Military Education: The United States

The US Maritime Services

Almost from the end of the Second World War, historians have understood the importance of professional military education in the development of the *Wehrmacht*'s battlefield capabilities.[15] What has only become clear in the 1990s was the extraordinary role that professional military education played in innovation and transformation in the American armed forces during this period.

The most interesting and important case was clearly that of the Naval War College in Newport, Rhode Island, an institution that provided the intellectual engine for the Navy's transformation and innovation efforts from the early 1920s through the start of World War II. In the interwar Navy, not only attendance at but teaching on the faculty of the Naval War College was considered career enhancing for officers on the fast track. Virtually every single admiral of note in the Second World War was a graduate of the Naval War College. Moreover, the future admiral Raymond Spruance served not one but two tours on the faculty.[16] Other admirals, such as Richmond Kelley Turner, also served on the faculty of the college.

The effect of serious professional military education showed directly in the Navy's efforts to transform its combat capabilities

The effect of serious professional military education showed directly in the Navy's efforts to transform its combat capabilities. If it had had little chance to test its battle fleet in World War I—only one squadron of US battleships made it to Scapa Flow—it had the opportunity at least to take a close look at what the British were doing. The

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[15] This was largely the result of the German military leadership's disinformation campaign after the war to excuse their role in the catastrophe. Of course, what they did not mention was that German professional military education completely failed to prepare the *Wehrmacht*'s officer corps for the strategic, logistic, and intelligence challenges that the coming war would present. For a discussion of these issues, see Murray, *German Military Effectiveness,* chap.1.

[16] This author has been told by professors at the Naval War College that only one future admiral over the past forty years actually taught on the faculty of the Naval War College before his promotion. As recently as six years ago, the biographies of admirals on active duty, supplied by the Navy's Office of Public Affairs, indicated that only half of the admirals on active duty had never attended a senior service college.

admiral in charge of the US efforts in European waters, Admiral William S. Sims, was one of the most intelligent and sophisticated naval officers in US history. Like the World War II fleet commander, Admiral Raymond Spruance, Sims returned from wartime service to become president of the Naval War College. There he set about adapting war games at the college to educate officers by providing surrogate decision-making experience in naval warfare. These games probed the framework of emerging concepts and technological change. In particular, the fleet games tested the possibilities that aircraft carriers might contribute to revolutionizing the conduct of maritime operations.[17] Serious, honest "red teaming" lay at the heart of the war gaming at Newport.[18] The resulting intellectually honest culture carried over into the Navy's fleet exercises throughout the interwar period. There was little effort to validate preconceived assumptions—the focus was on testing ideas and concepts until they failed.

Crucial to the gaining of this insight was the fact that those running the war games at Newport were open to new ideas and approaches

The most important insight to emerge from the Red-on-Blue war games at the Naval War College was that the tactical dynamics of offensive carrier operations differed fundamentally from battleship engagements. When battle lines of dreadnoughts engaged, the fires from the two sides concentrated more or less in steady streams. Each side could redirect its "stream" of fire on the enemy's surviving ships as the engagement progressed. However, the tactical war gaming indicated that carrier strikes should come in discrete pulses of combat power rather than in continuous streams. Thus, the effectiveness of such pulses on the enemy would be a linear function of the number of aircraft that an attacking carrier could launch in a given pulse or strike.[19]

Hence, the fundamental measure of carrier aviation in the future would be the number of aircraft that carriers could launch for a given mission. Crucial to the gaining of this insight was the fact that those running the war games at Newport were open to new ideas and approaches:

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[17] As one commentator on the development of war games has noted, Sims's war games "contributed substantially to the development of ideas about how to employ the aircraft carrier." Peter P. Perla, *The Art of Wargaming: A Guide for Professionals and Hobbyists* (Annapolis, MD, 1990), p. 71.

[18] For the importance of Red Teaming in the past, see Williamson Murray, "Red Teaming: Its Contribution to Past Military Effectiveness," DART Paper, Hicks and Associates, November 2002.

[19] Norman Friedman, Thomas C. Hone, and Mark D. Mandeles, *American and British Aircraft Carrier Development, 1919–1941* (Annapolis, MD, 1999), p. 34.

> As [Captain Harris] Lanning [the Director of the Tactics Department at Newport] noted in his memoirs, "a group of the cleverest tacticians among the students came to me and said that…they all believed there were better methods and intended to find them." Instead of being offended, Lanning backed them. As he recalled, "In investigating aircraft [in the war games] we gave the officers commanding miniature fleets a rather free hand in the use of aircraft…the only restriction being that planes had to operate in accordance with the capabilities and limitations as established by aviators familiar with planes."[20]

A game at the end of 1923 suggests the willingness of those designing fleet games at Newport to experiment with potential changes in fleet composition. In this exercise the Blue (American) fleet possessed five carriers, the Red fleet four. While much of the game emphasized the maneuvers of the battle fleets, the Blue fleet launched 200 aircraft at the Red fleet and damaged Red's carriers and one of its battleships. Besides pointing to the need for concentrated strikes against the enemy fleet, the game suggested the need for a coherent air-defense plan and the importance of gaining control of the air—thus the conclusion that the enemy's carriers must be the first target of carrier air strikes.[21]

The war games at Newport provided more than just an insight into the possibilities that carriers offered

The insight that the number of aircraft launched by a carrier would be the critical factor had far-reaching implications for the development of naval aviation. It suggested that in fleet engagements, striking first with aircraft would confer considerable advantages. It also indicated that range, payload, and sustainability would be essential elements in future naval equations. Newport's red teaming in relatively simple war games suggested not only that the more aircraft a carrier could take to sea, the better, but also that reducing aircraft launch, recovery, and on-board handling times would be essential to effective carrier operations. All of this was accomplished before the US Navy had a single operational aircraft carrier.

But the war games at Newport provided more than just an insight into the possibilities that carriers offered. They created a mindset in the Navy that would deal with the larger problems of a future war in the Pacific. Chester Nimitz's thesis at the Naval War College in 1923 noted the following about the operational and strategic framework of a possible future Pacific War:

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[20] Friedman, Hone, and Mandeles, *American and British Carrier Development,* p. 34.

[21] See particularly Stephen Peter Rosen, *Winning the Next War, Innovation and the Modern Military* (Ithaca, NY, 1991), p. 69.

[T]he operations imposed [in a future Pacific war] on Blue will require the Blue Fleet to advance westward with an enormous train, in order to be able to seize and establish bases on route…The possession by Orange [Japan] of numerous bases in the Western Pacific will give her fleet a maximum of mobility while the lack of such bases imposes on Blue the necessity of refueling at sea en route or of seizing a base from Orange for this purpose, in order to maintain even a limited degree of mobility.[22]

One hundred and fifty future generals in World War II attended the school during this period, while an astonishing fifty future generals worked for Marshall on the faculty

Consequently, the games and strategic analysis at the Naval War College led to the conclusion that the fleet would have to capture a number of the islands in the Central Pacific to support the drive to the Japanese Home Islands. And that task would require amphibious capabilities. Almost immediately after demobilization from World War I, the Marines had begun focusing on the possibilities offered by amphibious warfare for their survival as a military organization. The way ahead was chartered by Commandant John Lejeune, who proudly wore the combat patch of the Army's 2nd Infantry Division on his right shoulder. As the premier historian of the Corps has noted about Lejeune:

The Commandant intended that Marine officers study their profession, and he also intended that school completion be regarded as part of an officer's fitness for special assignments. It might also serve as a moral equivalent of promotion and the key to rapid advancement if the corps went to war again.[23]

Thus, the Marine Corps Schools at Quantico, Virginia, became the one place in the world where the implications of the British assault on the Gallipoli were studied not only for its failures but for what might have gone differently.[24] Between the mid-1920s and 1930s, the curriculum at Quantico saw a steady increase—from 25 percent to 60 percent—in the proportion devoted to the study of amphibious operations.[25]

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[22] Chester W. Nimitz, "1923 Naval War College Thesis," *Naval War College Review*, November–December 1983, pp. 12–13.

[23] Allan R. Millett, *In Many a Strife, General Gerald C. Thomas and the US Marine Corps, 1917–1956* (Annapolis, MD, 1993).

[24] Along these lines, Winston Churchill, in his great history of the war (*The World Crisis*), did, of course, examine Gallipoli in minute detail, but the British system of professional military education displayed not the slightest interest in that failure except to prove that such amphibious operations were impossible in the 20th century. For British attitudes toward amphibious operations in the late 1930s, see Williamson Murray, *The Change in The European Balance of Power, 1938–1939, The Path to Ruin* (Princeton, NJ, 1984).

[25] Allan R. Millett, "Assault from the Sea, The Development of Amphibious Warfare between the Wars, The American, British, and Japanese Experience," in *Military Innovation in the Interwar Period*, edited by Murray and Millett, p. 74.

Gallipoli became one of the main focuses of study, with an increasing emphasis on the tactical and operational movements once the amphibious force had achieved a beachhead. But beyond an increasing emphasis on amphibious warfare, the Marines also placed a number of their finest officers and future leaders on the faculty at Quantico. Other future luminaries on the faculty in 1938 included Lemuel C. Shepherd, Jr.; O. P. Smith; Merill B. Twining; David M. Shoup; and Gerald Thomas.[26]

Another point emerges from the contribution that institutions of professional military education made to the processes of transformation. Since they were so small, certainly in comparison to today's schools, it was relatively easy to form small groups of innovative officers who could interact and push concept development in imaginative new ways. Thus, the bureaucratic stranglehold of the bureaus could be loosened.

The Army

Like its sister services, the Army placed considerable emphasis on professional education, although there was a less coherent focus on transformation, innovation, and the development of new capabilities. That Leavenworth at times had a two-year curriculum probably had more to do with the fact that movement through the Army's ranks remained at a glacial pace throughout the interwar period than any desire to extend the intellectual horizons of the officer corps. For much of the period, the Army War College displayed little more intellectual vigor. Nevertheless, academic performance was a serious enough factor in officer evaluation for Dwight Eisenhower to expend great effort to graduate first in his class from Leavenworth.[27]

The real intellectual engine of the Army's efforts at transformation came at the Infantry School at Fort Benning, Georgia, during the five years that George Marshall served as assistant commandant. One hundred and fifty future generals in World War II attended the school during this period, while an astonishing fifty future generals worked for Marshall on the faculty.[28] An observer of the school during Marshall's tenure remarked at an atmosphere that encouraged officers

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[26] Millett, *In Many a Strife*, p. 128.

[27] Carlo D'Este, *Eisenhower: A Soldier's Life* (New York, 2002).

[28] Forrest C. Pogue with the editorial assistance of Gordon Harrison, *George C. Marshall*, vol. 1, *Education of a General, 1880–1939* (New York, 1963), p. 248.

To disagree at times on questions of military education, regardless of rank, and an attitude of tolerance of ideas which encourages free and open discussion. [The faculty was] thinking seriously about matters, old and new, that may find application in our Army of the future. They are not afraid to look outside the field of what is generally considered military education for ideas to help in solving the problems of national defense.[29]

How Marshall felt about professional education is suggested by his support for institutions like the Army War College in his first years as the Army's chief of staff, a time when the United States confronted the massive problems occasioned by rearmament in the face of the Nazi and Japanese threats. Out of seven faculty members teaching at that institution over the 1939–1940 academic year, Colonel W. H. Simpson would go on to command the Ninth Army in the European Theater of Operations, and Major J. Lawton Collins would become one of the Army's most distinguished corps commanders in World War II and eventually the Army's chief of staff. The following academic year would see Alexander Patch, eventually an army commander in World War II, on the faculty.

The Army Air Corps also placed considerable emphasis on its school, which was first based at Langley Field in Hampton, Virginia, and then moved to Montgomery, Alabama. The Air Corps Tactical School was the essential driver in the creation of the doctrinal concept of high-altitude precision bombardment that aimed at attacking select targets in what its theorists termed the enemy's "industrial web."[30] Whatever the difficulties that such doctrine presented to the actual carrying out of air operations in World War II, the Army Air Corps' leadership felt that education was important enough to assign significant numbers of its future World War II leaders to the

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[29]   Quoted in Pogue, *George C. Marshall*, vol. 1, p. 256. Marshall's attitude toward the study of the profession is summed up by the foreword he wrote to the classic study *Infantry in Battle*: "By the use of numerous historical examples which tell of the absence of information, the lack of time, and the confusion of battle the reader is acquainted with the realities of war and the extremely difficult conditions under which tactical problems must be settled in the face of the enemy." Major Harding, *Infantry in Battle* (Washington, DC, 1930), p. ix.

[30]   For an examination of the development of Army Air Corps doctrine, which was to have such a key impact on the conduct of the strategic bombing offensive against Germany, see among others Robert T. Finney, *History of the Air Corps Tactical School, 1920–1940* (Washington, DC, 1992); Thomas H. Greer, *The Development of Air Doctrine in the Army Air Arm, 1917–1941* (Montgomery, AL, 1955); Robert F. Futrell, *Ideas, Concepts, Doctrine: A History of Basic Thinking in the United States Air Force, 1907–1964* (Montgomery, AL, 1971); Lieutenant Colonel Thomas Fabyanic, "Strategic Air Attack in the United States Air Force: A Case Study," Air War College Report No. 5899, April 1976; and Murray, *Luftwaffe*, Appendix 1.

faculty. George Kenney, Haywood S. Hansell, Jr., Claire Chennault, Harold George, Kenneth Walker, and Hoyt Vandenberg all served tours there. The doctrine and theory they developed played a significant role in the destruction of the German war economy, once Army Air Force leaders recognized the necessity to adapt doctrine to the actual conditions of the war.[31]

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[31] For a discussion of the difficulties that American airmen encountered in attempting to execute their theories against the Germans in the Second World War, see Murray and Millett, *A War to Be Won,* chap. 12.

Experimentation and Transformation

The Maritime Services

Perhaps the most impressive aspect of American transformation and innovation in the interwar period lay in the ability of the services to translate intellectual insights and thinking into experiments and exercises that had a direct impact on the development of combat capabilities. In turn, those improving capabilities were often fed back directly to the schools, where real-world experience could refine doctrine and concepts. The development of the carrier underlines these processes most clearly.

As suggested previously, the key insight in the Naval War College war games in the early 1920s was that pulses, rather than streams, of air power represented the best way to "fight" the carrier. One result of this insight was that when future admiral Joseph M. Reeves went to sea with the Navy's first carrier, the USS *Langley*, in 1925, he immediately set about experimenting with the ship and its aircraft to maximize the potential for launching and recovering large numbers of aircraft.[32] Significantly, Reeves had attended the senior officers course at Newport in 1923, and after graduation had become the head of the tactics department, where he supervised the 1924–1925 games.[33]

By the time that he left command of the *Langley*, Reeves' intense pressure on crew and pilots alike had significantly shortened takeoff and landing times for larger numbers of aircraft. Thus, in one year, Reeves increased the number of aircraft the *Langley* could generate in simulated combat conditions from fourteen to forty-eight.[34] In that period, Reeves and his officers figured out how to use arresting cables to maximum effect, invented crash barriers, developed the concept of the deck park, and

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[32] Stephen Peter Rosen, *Winning the Next War, Innovation and the Modern Military* (Ithaca, NY, 1991), p. 42. The innovations of Reeves were critical in showing that carriers could handle large numbers of aircraft in combat situations. With that insight, the Navy was positioned to take full advantage of the huge carrying capacity that the *Lexington* and *Saratoga* would offer upon their completion as aircraft carriers.

[33] Rosen, *Winning the Next War,* pp. 40–43.

[34] Rosen, *Winning the Next War,* pp. 40–43.

began the processes of refueling and rearming aircraft at faster speeds. It is doubtful whether there has ever been a more impressive use of low-cost resources than the relatively inexpensive games that Sims designed and led at Newport in the early 1920s and the experiments that resulted from their insights.

In the longer term, perhaps the most impressive attribute of the Navy's efforts at innovating carrier aviation was that by the mid-1920s, there was a direct interaction between the games at Newport and the fleet exercises. The concepts and insights gained at Newport were fed directly into the design for those exercises, which involved Red-on-Blue engagements. At the conclusion of the fleet exercises—the umpires often coming from the cadre of instructors at Newport and returning to the faculty—the results directly affected the tactical and operational games that took place at the war college.

That interaction was crucial to understanding the potential of carrier aviation as well as pushing the Navy to develop the aircraft capabilities that would revolutionize naval warfare. In FLEET PROBLEM IX in early 1929, the new carrier *Saratoga* detached from the Red battle fleet, struck the Panama Canal, and caught the defending forces by surprise. In the "hot wash" after the exercise, all the senior officers were present, and the commander of the force that included the *Saratoga* noted,

> [W]hen we learn more of the possibilities of the carriers, we will come to an acceptance of Admiral Reeves' plan which provides for a very powerful and mobile force...the nucleus of which is the carrier.[35]

Connecting theoretical work at institutions of professional military education to the real world of exercises laid the groundwork for the Navy's successes during the Second World War. Even though not all insights could be acted upon, ideas and concepts remained available for the time when sufficient resources became available. For example, as early as 1921, war games suggested that underway replenishment would be an essential element in a campaign across the Pacific. However, throughout most of the interwar period, there was simply not the funding to work out the possibilities. Of the greatest importance was that the habits of mind created at Newport carried on into the conduct of war. From the Marianas campaign, Nimitz would spend sev-

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[35]   Rosen, *Winning the Next War,* p. 49. Not all of the lessons were learned or remembered. In one of the fleet exercises in the early 1930s, the Red fleet achieved a notable success in striking the defending fleet in its base at Pearl Harbor.

eral days war gaming and red teaming the possibilities inherent in upcoming opera-
tions with his staff and principal commanders.[36]

The development of amphibious capabilities by the Marine Corps and the Navy
came more slowly than the development of carrier aviation. Part of the explanation
is that much of the Marine Corps' focus in the 1920s was on policing actions in the
Caribbean. But with the withdrawal of Marine units from that role in the early 1930s
and their re-designation as the "Fleet Marine Force," the maritime services began an
active program of designing fleet exercises—FLEXs, the acronym of the time—to
test the possibilities of amphibious landings. By 1934 the Marines had developed a
manual for such operations, the *Tentative Manual for Landing Operations,* while increas-
ing tensions in the Pacific made it more likely that a great conflict between the
United States and the Empire of Japan would occur.

The result of these efforts was that the Navy and Marine Corps carried out a signifi-
cant number of FLEXs based on the doctrine emerging from the Marine Corps
Schools:

> In the course of the FLEXs the navy and marine corps experimented with
> just about every imaginable amphibious technique and tactical approach al-
> lowed for by their equipment. They tried day and night landings, smoke
> screens, varieties of air and naval gunfire support, concentrated assaults and
> dispersed infiltration, the firing of all sorts of weapons from landing craft,
> and an array of demonstrations, feints, subsidiary landings, and broad-front
> attacks.[37]

All the while, debates went on throughout the Navy and Marine Corps, fueled by
experiences gained in the FLEXs. By 1940 the parallel development of doctrine and
experimentation had created amphibious capabilities that needed only the addition
of significant resources. The resulting capabilities eventually played a crucial role in
the Allied victory in the Second World War in both Europe and the Pacific.[38]

For the Army, the
connection be-
tween experimen-
tation and the
work in school-
houses was more
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than with the
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Corps

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[36] Barry D. Watts, "Diagnostic Observations on Theater-Level War Gaming," unpublished paper,
presented at National Defense University's "Thinking Red in War Gaming" Conference, 23–25
April 1985, p. 7.

[37] Millett, "Assault from the Sea," in Murray and Millett, *Military Innovation in the Interwar Period,* p. 77.

[38] By that time, Marine and Navy planners had reached the conclusion that "an amphibious expedi-
tionary force could not rely on guile for success, but would require local superiority in every ele-
ment of air, naval, and ground combat power." Millett, "Assault from the Sea," in Murray and

The Army and the Army Air Corps

For the Army, the connection between experimentation and the work in school-houses was more ambiguous and less successful than with the Navy and Marine Corps. Although there were a number of reasons for this state of affairs, perhaps the most difficult to assess is the inherently greater complexity of ground combat compared with war in the other dimensions. The Army did have an exceedingly good base to start from, namely, Field Service Regulations of the early 1920s, that rested on the solid lessons-learned analyses that Pershing had commissioned in 1919.[39]

With an Army that was approximately the same size as the German *Reichswehr*, it would seem that the stage had been set for the development of combined-arms warfare along the lines of what was occurring in Germany. But substantial difficulties prevented experiments and exercises that might have provided American officers with the insights the Germans achieved. The first had to do with the Army's promotion system, which systematically ensured that talented officers received absolutely no preference over their more senile and incompetent colleagues. Thus, the cultivation of talented and bright officers, who could drive transformation, as occurred with the Germans, did not occur in the US Army.

Equally harmful to experimentation and the kinds of exercises that could have developed and nurtured an understanding of the operational level of war was America's enormous expanse. Scattered across thousands of miles in tiny garrisons, the Army was not able to gather its troop units together for major exercises until war had already broken out in Europe. The Louisiana Maneuvers of 1940, which enabled George Marshall to identify so many first-class officers as well as the deadwood, provide a hint at the contribution such exercises and experiments might have made to sharpening the officer corps, along with developing concepts and doctrine. Finally, the parsimony of the executive and the legislative branches was such that the Army could barely maintain itself in its enclaves—most of which were far removed from American society.[40] The result of these factors was that the Army had to learn com-

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Millett, *Military Innovation in the Interwar Period,* p. 77. That was not the approach Army planners fully accepted in the European Theater of Operations, as the events at Omaha Beach underline.

[39] William Odom, *After the Trenches: The Transformation of Army Doctrine: 1918–1939.* (College Station, TX, 1999).

[40] The inability to carry out exercises on a regular basis probably gave too many Army leaders an unrealistic view about how easy it was going to be to train and prepare ground forces that would be able to stand up to the *Wehrmacht* in combat.

bined-arms tactics on the battlefield at great cost to its soldiers. In the European Theater of Operations, it only managed to master the operational level of war in 1945.[41]

The great problem the Army Air Corps' leaders confronted in the late 1930s was that their theories of future war in the air were largely unprovable—at least until its forces were engaged in combat. Here, American airmen should have enjoyed a considerable advantage over the European air forces—the Army air forces were not committed to combat in Europe until 1942, nearly three years after the war had begun. Over the course of that period, there was considerable evidence, especially in the Battle of Britain, that confirmed the harsh lessons of the last conflict—namely, that air superiority was the *sine qua non* of all other air operations and that target identification, bombing accuracy, and damage assessments were all fraught with uncertainties and ambiguities. Unfortunately, by 1940 American air doctrine had become dogma, and the lessons learned at considerable cost by others were judged to be irrelevant in the case of American air power. Thus it would take not one, but two, Schweinfurts[42] to persuade Army Air Force leaders of the kind of war they were actually fighting

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[41] That the Germans were able to escape largely intact from Falaise, the third case by that time, suggests how unprepared senior American commanders were to wage war at the operational level, George Patton being the exception.

[42] Schweinfurt, a small town in Germany, was the scene of two disastrous raids in World War II. Allied forces lost 60 B-17s on both raids over Schweinfurt.

Transformation, Innovation, and Tactical Preparations

The great weakness in transformation efforts in the US military during the interwar period lay in the inadequacies involved in translating operational and tactical concepts into actual combat capabilities. The most obvious impediment to improving tactical performance in the period immediately before the war was that commanders lacked the technological devices that have added so much to the realism of combat training in the last two decades of the twentieth century.[43] There was simply no means to calculate how well or realistically a unit was preparing for combat. Such difficulties were exacerbated because few of the Army's officers had combat experience in the First World War, while virtually none of the Navy's officers had any combat experience at all.

But there were other difficulties as well. The most important of these was a general overconfidence—arrogance in many cases—and a tendency among American officers to underestimate potential opponents. This was particularly true of American judgments of Japanese tactical competence, where racial stereotypes clearly figured in the overall American view of their future Pacific opponents. The results were disastrous in the defense of the Philippines and the initial fighting in the Solomons.[44] The Navy's underestimation of the Imperial Japanese Navy resulted in humiliating defeat at Savo Island and the embarrassments that occurred over succeeding months

A general overconfidence—arrogance in many cases—and a tendency among American officers to underestimate potential opponents

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[43] The introduction of technological training aids in the aftermath of the Vietnam War created a revolution in the ability of the services to evaluate the tactical performance of their units in training. The instrumented ranges of Red Flag and Top Gun improved the training of fighter pilots by an order of magnitude. But equally important was that the Army and Marine Corps created instrumented training ranges, especially the National Training Center and Twenty-Nine Palms, that allowed for a more realistic evaluation of the mistakes made by ground units during their training cycles. The effect of those technological training capabilities showed clearly in the performance of US forces in the Gulf War against the supposedly battle-hardened Iraqi military.

[44] The Marines largely escaped the penalties of such underestimations by the fact that in their first great battle, Guadalcanal, the Japanese underestimated them to an even greater extent. Tarawa did not indicate an unprepared force or an underestimation of the Japanese. Rather, it indicated how heavy the cost could be without proper preparation in digging out a well-dug-in opponent holding a strategically important island. Sadly, Army commanders in Europe paid no attention to the lessons of Tarawa in planning the landings at Omaha Beach.

in the Slot, the waters between the Solomon Islands. The difficulties in the first clash against the *Wehrmacht* were less overtly the result of an underestimation of the German opponent. Nevertheless, the Battle of Kasserine Pass indicates how underprepared US ground forces were to handle the German Army, while the Army Air Forces would suffer their own disastrous experiences in the skies over Schweinfurt—not once, but twice.

Two final contributing factors were largely beyond the control of American military leaders. First, the general unwillingness of Congress and American presidents to support serious military preparations until the last moment, when it was almost too late, made it extraordinarily difficult to build tactical skills at the most basic levels. Then, when the purse strings were finally loosened, American military leaders confronted the difficulties involved in massive mobilization from a tiny base to the enormous forces that the United States would eventually deploy around the world. As a result, to a great extent, US trainers and planners had to be satisfied with "good enough" rather than the best. The tactical "best" would be learned at the sharp end—at the cost of large numbers of young Americans and national treasure.

Conclusion

The transformation of the American military between 1920 and 1930 is indeed an extraordinary story, especially when the handicaps are taken into account. Small groups and a number of key individuals, like Admiral Sims, the future General Marshall, made an enormous difference, particularly from within the system of professional military education. Much more than on technology or resources, the American successes rested on serious intellectual effort that came to grips with intractable problems.

And yet when all is said and done, too many officers in all the services were satisfied with simply going through the motions in peacetime. The tyranny of peacetime military organizations and their peacetime pursuits resulted all too often in confusing polishing brass, painting rocks, and having spotless uniforms with actual preparation for the nightmare and uncertainties of combat. Michael Howard's comments about the British Army during the interwar period could equally be applied to too many American officers during this period:

Too many officers in all the services were satisfied with simply going through the motions in peacetime

> The evidence is strong that the army was still as firmly geared to the pace and perspective of regimental soldiering as it had been before 1914; that too many of its members looked on soldiering as an agreeable and honorable occupation rather than as a serious profession demanding no less intellectual dedication than that of the doctor, the lawyer, or the engineer.[45]

As we look into the decades of the twentieth century, the difficulties of transformation and innovation in the 1920s and 1930s suggest the difficulties of the paths ahead. There are no silver bullets, no simple solutions. Only hard, unrelenting, rigorous testing of concepts and doctrine and honest, serious intellectual effort can prepare America's military forces to meet the challenges of an uncertain and ambiguous future.

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[45] Michael Howard, "The Liddell Hart Memoirs," *Journal of the Royal United Services Institute*, February 1966, p. 61.

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Notes

Looking at Two Distinct Periods of Military Innovation: 1872–1914 and 1920–1939

Williamson Murray
October 2002

Contents

Interwar Military Innovation

1920-1939

&

1872-1914

Williamson Murray

Institute for Defense Analyses

Slide 2. Outline

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Outline

- Background to Briefing
- The Problem
- The 1920 to 1939 Period
- The 1872 to 1914 Period: A New Paradigm?
- Conclusion

2

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This briefing is largely based on two major studies, "Military Effectiveness" and "Military Innovation in the Interwar Period" undertaken in the 1980s and early 1990s at the direction of Mr. Andrew Marshall, Director of the Office of Net Assessment in the Pentagon.[1] These studies examined the patterns of history as well as the experiences of military institutions to discover those institutional qualities, culture, and organizational dynamics that had contributed in the past to military effectiveness and successful innovation in periods of rapid technological change. Mr. Marshall also engaged a number of other scholars on similar projects examining the processes of innovation in the 1920s and 1930s.[2] This body of work, this author believes, has yielded significant insights into the processes of successful as well as unsuccessful innovation.

Nevertheless, the period we are embarking on is beginning to look more and more like the interwar period between 1872 and 1914, where massive, revolutionary technological change entirely reordered the face of civilian society and presented military institutions with new, intractable, and in many cases unsolvable problems—problems solvable only after four years of massive destruction and killing in World War I. Thus, the last portion of this briefing will attempt to bring together insights from both periods and their implications for successful military innovation in the twenty-first century.

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[1] Both of these studies were eventually published: Allan R. Millett and Williamson Murray, *Military Effectiveness*, vol. 1, *World War I;* vol. 2, *The Interwar Period*; and vol. 3, *World War II* (London: Allen and Unwin, 1988); and Williamson Murray and Allan R. Millett, *Military Innovation in the Interwar Period* (Cambridge: Cambridge University Press, 1996).

[2] See particularly Thomas C. Hone, Norman Friedman, and Mark Mandeles, *American and British Aircraft Carrier Development, 1919–1941* (Annapolis, MD: Naval Institute Press, 1999).

Slide 3. The Problem

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│                                                │
│               The Problem                      │
│                                                │
│  • Military institutions cannot practice in    │
│    peace much of what they may have to         │
│    execute in war                              │
│     – Impossible to replicate in peace the     │
│       conditions of war                        │
│     – Fog, ambiguity, uncertainty, but above   │
│       all terror, fear, and horror form the    │
│       environment                              │
│  • Since 1815 periods of peace have occurred   │
│    during times of accelerating technological  │
│    change                                      │
│     – The technological, social, and doctrinal │
│       changes have resulted in enormous        │
│       military disruption                      │
│                                              3 │
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Since the mid-nineteenth century, military institutions have confronted two major problems when they embark on war: The first has to do with the fact that it is impossible to replicate in peace the actual conditions of war. This has been a traditional impediment to military effectiveness since the "Western way of war" first emerged in the seventeenth century. More often than not during periods of peace, military institutions do not know where, when, and against whom they will fight. Not surprisingly, they then find themselves engaged in conflict under conditions for which they have done little to prepare.[3] Moreover, it is impossible to replicate during peacetime the extraordinary conditions of war, where their opponents aim not only to wreck their plans and goals, but to kill, maim, and wound their soldiers, sailors, and airmen. Thus, to the normal conditions of ambiguity and uncertainty that mark all human life are added terror, fear, and horror—none of which contribute to the ability to make clear, rational decisions.[4] The resulting frictions, the

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[3] The classic example of this in American military history was, of course, the Civil War, where the United States Army had focused for virtually its entire history on the problems of dealing with small numbers of marauding Indians on the frontier. But in 1861, generals on both sides found themselves in command of great armies that consisted of tens of thousands, where the year before the biggest units they had ever seen consisted of under-strength regiments. Similarly, the United

States Army entered the Vietnam War almost entirely focused on fighting the Red Army on the plains of Central Germany; its persistence in continuing to fight in that fashion was one of the major factors that led to defeat in that war. In the latter case, see particularly Andrew Krepinevich, *The Army in Vietnam* (Baltimore, MD: Johns Hopkins University Press, 1986).

[4] Clausewitz in his classic examination of the factors involved in war describes the increasing horror and confusion that a new soldier, inexperienced in war, confronts in his movement from the rear areas to the front lines. See Carl von Clausewitz, *On War*, edited and translated by Michael Howard and Peter

combination of non-linear, unpredictable events, make the conditions under which military institutions operate in war extraordinarily different from the conditions under which they prepare for conflict.[5] Thus, they have found that their prewar preparations have not prepared them to handle the tactical and operational challenges they have confronted on the battlefield.

Exacerbating the gulf between peacetime innovation and the conditions of future battlefields has been the fact that, since the early nineteenth century, the Western world has undergone vast technological changes.[6] Over the course of the past two centuries, the pace of technological change has been increasing, making the problems of innovating in peacetime even more difficult while revolutionary technological changes in civil society have had enormous implications for how military organizations prepare for war.

Thus, they face considerable disruptions in their patterns of thought not only because of the effect of technological change on their capabilities, but also because of the impact of vast technological changes on the external society.[7] In neither case do military institutions confront easily solved problems. And in almost every case they can only discover complete answers in the wreckage of the battlefield.

Paret (Princeton, NJ: Princeton University Press, 1975), p. 113-114.

[5] For the fact that the conditions of war will not change in the future see Barry W. Watts, *Clauswitzian Friction and Future War* (Washington, DC: National Defense University Press, 1996).

[6] For the extent and influence of these technological changes, see William H. McNeil, *The Pursuit of Power, Technology, Armed Force, and Society Since A.D. 1000* (Chicago: University of Chicago Press, 1982); see also Martin van Creveld, *Technology and War, From 2000 B.C. to the Present* (New York: The Free Press, 1989).

[7] What we are talking about here has to do with the difference between military revolutions and revolutions in military affairs. In the former case military institutions have confronted the effect of enormous social and technical change in the external society, such as the effect of the French and Industrial Revolutions; by in large they have had little chance to influence those revolutions. In the later case, revolutions in military affairs, they have had some opportunity to adapt and control the effect of technology. See in particular MacGregor Knox and Williamson Murray, *The Dynamics of Military Revolution, 1300–2050* (Cambridge: Cambridge University Press, 2001).

Slide 4. Military Innovation 1920-1939

Military Innovation 1920–1939

• Characteristics of Period
  – Period of technological change
  – Military organizations had just emerged from WWI
  – Most had clear strategic enemy in mind in developing or refining capabilities
  – Period of limited resources
  – Nevertheless, the future implications of doctrinal and technological innovation remained uncertain and ambiguous

4

As with all historical examples, the context matter. Military institutions in the period between 1920 and 1939 confronted a number of distinct challenges that are similar in many ways to the emerging challenges that confront the US military in the twenty-first century. This interwar period was one marked by considerable technological change, one in which the sciences—in particular, physics—as well as technology greatly influenced the preparations and innovations of military institutions. And the conditions under which those institutions innovated were, more often than not, the result of the peculiar political and strategic context of the time.

In particular, military institutions were directly affected by the terrible events of the Great War through which they had so recently passed The experiences of World War I would mold their outlook and approach to innovation Moreover most of those institutions had a clear opponent in mind as they developed and experimented with new concepts.

At the same time, for most of this interwar period, there were severe constraints on the financial support available. The German Army found its ability to innovate limited by the constraints of the Great Depression as well as the Treaty of Versailles until Adolph Hitler was named chancellor of the Reich.[8] The situation of the German military then radically altered with the Nazi takeover in early 1933, but for other military institutions, particularly those of the democracies, the situation did not change, with regard to limited resources until the late 1930s.[9]

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[8]   There is after all just so much one can do in replicating the potential of weapons systems by covering cars with plywood to represent tanks or by using motorcycles to replicate the movement of aircraft during maneuvers, as the Germans were forced to do from 1919 through 1932.

[9]   Rearmament for the US Army did not begin until summer 1940 with the fall of France. Serious rearmament for the British Army began only in spring 1939, when the Chamberlain government finally recognized the need for the commitment of

Nevertheless, whatever the level of support
or the clarity of potential opponents, the
future implications and the direction of mili-
tary innovation remained substantially uncer-
tain and ambiguous to all who were serious
about innovation. Even those who experi-
mented seriously with future military capa-
bilities remained unclear as to what the next
war would bring in its wake.[10]

British ground forces to the Continent to support
France. For the latter see Williamson Murray, *The
Change in the European Balance of Power, 1938-1939,
The Path to Ruin* (Princeton, NJ: Princeton Univer-
sity Press, 1984), chpts. 1 and 8.

[10] For example, the future Field Marshal Gerd von
Rundstedt turned to the German tank pioneer
Guderian Heinz after one experiment with ranks
and commented, "Alles Unsinn, meine lieber Gud-
erian, alles Unsinn (all nonsense, my dear Gud-
erian, all nonsense)." M. Plettenberg, *Guderian:
Hintergrüde des deutschen Schickals, 1918–1945* (Dus-
seldorf, 1950), p. 14.

Slide 5. What Matters

What Matters

- Context
- Institutional Framework
- Military Leadership
- Military Culture

5

The historical record suggests four major areas that affect the degree to which military institutions innovate successfully. The next six slides with their commentary examine the framework within which institutional innovation largely took place during the 1920s and 1930s.

Slide 6. The Context Matters

> ## The Context Matters
>
> - Military organizations that had a discernable enemy innovated more coherently
>   - German Army: combined arms: Poland, France
>   - US Navy: carrier war: Japan
>   - US Marine Corps: amphibious war: Japan
>   - RAF Fighter command: system–based air defense: Luftwaffe
> - Those who innovated against a generic opponent had major difficulties
>   - RAF Bomber Command and the US Army Air Corps
> - World War I exercised an enormous influence over interwar innovation
>
> 6

The context in which military innovation takes place has a considerable effect on how successfully or not military organizations innovated during this period. To begin with, the last war exercised an enormous influence over how they prepared for the next war. Historians have often argued that military institutions study the lessons of the last war and that is why they do badly in the next. But history suggests otherwise. Rarely do military institutions study their recent military experience, and even then they largely study their successes rather than their failures.[11] Thus, while the last war exercised a considerable influence over military innovation, it largely did so, for example, by the influence it had on the minds of political elites in the democracies and their imposition of severe limits on defense spending in the face of the greatest dangers.[12] Unfortunately, it was the German Army that ruthlessly and honestly studied the lessons of 1918 and as a result, managed to transfer those lessons to the battlefields of the next war.[13]

One of the sharpest lessons of this period appears to have been that successful military innovation required a sharply defined opponent against whom military institutions could focus their efforts to transform their forces. This was particularly true of the United States. The carrier war games at the US Na-

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[11] The German Army studied very carefully its tactical performance in World War I, where it had generally outperformed its opponents. However, it did not study the egregious mistakes that it had made on the strategic level and thus managed, with some help from Hitler, to repeat virtually every strategic mistake in the next conflict. See Williamson Murray, *German Military Effectiveness* (Baltimore, MD: Nautical and Aviation Press, 1992), chpt. 1.

[12] See Murray, *The Change in the European Balance of Power*, chpt. 2.

[13] Interestingly, the German Navy did *not* study its performance in World War I honestly during World War I, which would be a considerable factor in its defeat in the next conflict. See particularly Holger Herwig, "Innovation Ignored, The Submarine Problem—Germany, Britain, and the United States, 1919–1939," in Murray and Millett, *Military Innovation in the Interwar Period*, chpt 6.

val War College in Newport were specifically aimed at extending the fleets reconnaissance capabilities and eventually its combat reach in the vast reaches of the Pacific.[14] But those distances and the logistical difficulties they presented forced US Navy strategists and war ga7mers to think about the importance of capturing bases across the Pacific to support the offensive against the Japanese Home Islands. That context in turn led the Navy to support US Marine Corps efforts to develop amphibious capabilities actively.[15]

Not surprisingly, the German efforts to develop mechanized combined-arms warfare also were greatly influenced by their potential opponents for much of the interwar period: France, Poland, and Czechoslovakia.[16] But until the late 1930s the Germans were also influenced by the context of a possible future war in which their opponents would enjoy numerical superiority. Consequently, they emphasized mobility in their concepts and experiments right from the beginning of the interwar period. Their first experiment in mobile warfare occurred in 1922, four years

before the first British experiment, and continued right through to 1939.[17]

Military organizations that innovated in a generic sense with no clear opponent in mind found considerable difficulty in developing a coherent and realistic picture of what future war might look like. In this regard, the Royal Air Force (RAF) and the US Army Air Corps developed views of future war that proved largely unrealistic in view of the conflict they eventually fought.[18] Thus, both air forces ended up emphasizing strategic bombing capabilities to the exclusion of virtually all other possible air power missions. The result was that neither air force was capable of performing such missions as reconnaissance, interdiction, or close air support in the early years of World War II— missions that played major roles in the opening campaigns of the Second World War.

On the other hand, the *Luftwaffe*, which had prepared itself to gain air superiority and then support the German Army in its operations on the Continent, was able to make major contributions to German victories in the early years of the coming conflict.[19[

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[14] The most outstanding work on the US Navy's innovations with carriers is Thomas C. Hone, Norman Friedman, and Mark Mandeles, *American and British Carrier Development, 1919–1941* (Annapolis, MD: Naval Institute Press, 1999). See also Barry Watts and Williamson Murray, "Military Innovation in Peacetime," in *Military Innovation in the Interwar Period*, chpt. 10.

[15] For that Marine Corps effort, see particularly Allan R. Millett, "Assault from the Sea: The Development of Amphibious Warfare Between the Wars— the American, British, and Japanese Experiences ," in Murray and Millett, *Military Innovation in the Interwar Period*, chpt. 2.

[16] See Williamson Murray, "Armored Warfare: The British, French, and German Experiences," in Murray and Millett, *Military Innovation in the Interwar Period*, chpt. 1.

[17] For the German emphasis on the importance of mobility, see Reichswehrministerium, Chef der Heeresleitung, "Betr: Harzübung, 8.1.22," National Archives and Records Service microfilm of captured German records, T-79/65/000622.

[18] The fact that the RAF developed an effective air defense system was largely the result of decisions taken by the Chamberlain government—largely against RAF advice—that placed the emphasis in British aircraft procurement on fighters. Ironically, the government took this decision not because fighter aircraft were cheaper than bombers. Murray, *The Change in the European Balance of Power,* p. 82.

[19] For the *Luftwaffe*'s development of its warfighting concepts and doctrine, see Williamson Murray, *Luftwaffe* (Baltimore, MD: Nautical and Aviation Press, 1984), chpt. 1.

Slide 7. The Institutional Framework Matters

> # The Institutional Framework Matters
>
> - Innovators need access to resources
>   - Both intellectual and financial
>   - Personnel policies crucial
>   - External support often a major player
> - Successful innovation demanded clear tie to legacy forces
> - Innovators needed to think outside the box, but did not break ties to their institution
>   - Institutional culture crucial to innovation
>
> 7

Military organizations are complex bureaucratic institutions. Consequently, their institutional framework matters:

▶ their position in the structure of government;

▶ how they react to new ideas; their personnel policies, which can either encourage or discourage the innovators within their organization; and

▶ the level of external support for innovation.

Because of the difficulties and complexities involved in developing new concepts and utilizing military institutions, there can be no single organizational structure that will encourage successful innovation. National historical experience and the history and culture of the organization itself all contribute to the success or failure of institutional innovation. Nevertheless, there are a number of institutional attributes that can lead to successful innovation.

First, innovators within an organization need *access to resources*. Financial resources are obviously of considerable importance. But of equal importance are the *intellectual resources*. Thus, personnel policies encouraging innovation are essential. Such policies must encourage innovators by providing *new career paths* within the officer corps.[20] They must also *protect the innovators* from punishment for holding heretical ideas.[21]

Along these lines, *external support* for innovators can prove crucial to the success of their efforts. Before he assumed the position of

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[20] See particularly Stephen P. Rosen, *Winning the Next War, Innovation and the Modern Military* (Ithaca, NY: Cornell University Press, 1991)

[21] Here the culture of the German Army was crucial in protecting the panzer advocate Heinz Guderian from the wrath of those wounded by his abrasive and truculent personality. The fate of tank advocates in the British Army like J. F. C. Fuller and Percy Hobart stands in stark contrast to Guderian's rapid ascent to the senior ranks of the German Army.

BuAer, Admiral William Moffett assured himself the support of leading Republican politicians.[22] One of the results of his close connection with politicians was the fact that the Morrow Board, created to make changes in US aviation policy, recommended that the command of aircraft carriers only be given to aviators. The result was that a number of naval officers, some quite senior, went to flight school so that they could qualify for carrier command.[23]

Successful innovation also demands *a clear tie to legacy forces*. In fact, innovation often results in new forces, which, while they represent a relatively small portion of the overall force structure, are able to leverage legacy capabilities to make the overall force significantly more capable. Thus, the German panzer divisions represented less than 10 percent of the *Wehrmacht's* overall force structure in 1940. Nevertheless, those divisions were able to increase the capabilities of legacy forces significantly. Moreover, it was the close cooperation between new and legacy forces that made the German drive in 1940 through the Ardennes so devastating.[24] Similarly, the

use of US F-117 Stealth aircraft during the opening night's attack on Iraq's air defense system played a major role in allowing legacy aircraft to destroy Iraq's integrated air defense system in a matter of hours.[25] *It was the combination of new and legacy capabilities, working within an overall conception of what needed to be done, that made the Coalition air offensive so devastating.*

Military innovators do need to think outside the box. Nevertheless, the most successful innovators in the 1920s and 1930s remained within the organization in terms of their conceptions as well as their relationship with the officer corps as a whole. No matter how strong the German armor pioneer Heinz Guderian may have been in his advocacy of panzer forces from 1926 through to the beginning of the war, he remained within the Second World army's bureaucratic and intellectual framework. Two factors enabled him to do so. The first was the bureaucratic and cultural traditions of the general staff that encouraged junior officers to speak their minds without fear of affecting their careers negatively. The second factor was that Guderian's ideas fit within the overall pattern of tactical conceptions that all German officers

22 See Watts and Murray, "Military Innovation in Peacetime," in Murray and Millett, *Military Innovation in the Interwar Period,* pp. 393–394

23 One of these was the future admiral William F. "Bull" Halsey who would play a major role in US carrier operations during the Second World War.

24 The legacy forces themselves were to make major contributions to the German success at both the tactical and operational levels. At the operational level, the advance of Army Group B, largely conducted by old-style infantry divisions, fixed the attention of the French High Command on northern Belgium; meanwhile, on the tactical level, German rifle regiments, supported by artillery, were able to make the crucial crossing of the Meuse River, thus opening the way for the armored exploitation later in the battle. See particu-

larly Williamson Murray, *Experimental Units: The Historical Record*, IDA Paper P-3684 (Alexandria, VA: Institute for Defense Analyses, May 2002). For the 1940 campaign in general see Karl-Heinz Frieser, *Blotzkrieg Legende, Der Westfeldzug 1940* (München: R. Oldenbourg Verlag, 1995); and Williamson Murray, "May 1940, Contingency and Fragility of the German RMA," in Knox and Murray, *The Dynamics of Military Revolution*, chpt. 8.

25 See Williamson Murray, *The Air War in the Gulf* (Baltimore, MD: Nautical and Aviation Press, (1995), chpt. 2.

held.[26] On the other hand, the British tank advocate J. F. C. Fuller, no matter how innovative his thinking, eventually broke with the army, partially as a result of the army's disdain for intellectual soldiers who disturbed the status quo and partially because of his own acerbic personality.[27]

Finally, we might note that institutional culture matters enormously in the success or failure of military innovation. We will address this factor extensively in a section below.

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[26] This factor is one of the major explanation for why so many successful panzer commanders in the Second World War came from other branches. Erwin Rommel, for example, was an infantryman through to the end of 1939. Nevertheless, he was able to make the transition to the command of a panzer division in a matter of months and then lead that unit, the 7th Panzer Division, in devastating fashion in the campaign that opened against the French Army on 10 May 1940.

[27] The title of one of Fuller's books, *Generalship: Its Diseases and Their Cure*, suggests that the break between Fuller and the British Army was not entirely due to the institution.

Slide 8. Military Leadership Matters

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Military Leadership Matters

- Top-down leadership crucial to the process of successful innovation
  – Guderian, Moffett, Dowding, Lejeune, Tukhachevsky
    - But required feedback loops from experiment and exercises
    - Had to be receptive to ideas from below
    - Decentralized approach to change
- Top-down leadership was disastrous when it decreed the *truth*
- Successful innovators held positions for sustained periods of time
- With exception of creation of (RAF) Fighter Command, successful military innovation evolutionary rather than revolutionary

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One of the most important factors in successful innovation is clearly leadership, particularly leadership at the top. Admiral William Moffett, Air Marshal Hugh Dowding, the first commander of the RAF's Fighter Command, General John Lejeune, Commandant of the US Marine Corps in the early 1920s, all pushed significant innovations from their positions at the highest levels.

When first assigned the responsibility for armored warfare by the General Staff in 1926, Heinz Guderian, was a relatively junior major, who rose through to the highest levels of the Wehrmacht by the late 1930s along the way he too received considerable support from senior leaders.[28] Such senior officers used their senior positions to en-

courage subordinates to follow innovative paths to the development of future capabilities.

Moreover, most of those who played major roles in forwarding the processes of innovation either held positions of leadership for substantial periods of time or were connected to the processes of change during much of the time that innovative capabilities were evolving. Admiral Moffett took over command of BuAer in 1921 and remained in that position until he died in the crash of the airship Akron in 1933 despite the efforts of a number of more senior naval officers to remove him. His longevity was largely enabled by his connections with the Congress.[29]

[28] In Guderian's memoirs, he mentions General Werner von Fritsch, commander-in-chief of the army during the most critical phases of rearmament. Heinz Guderian, *Panzer Leader* (New York: Da Capo Press, 1996), pp. 35-36.

[29] On the importance of Moffett's lengthy tenure and the battles he had to fight, see especially Hone, Friedman, and Mandeles, *American and British Aircraft Carrier Development*, pp. 181–185.

Guderian, while appointed as the general staff officer in charge of tank development, had direct charge of the initial push towards innovations in mechanized warfare. However, when rearmament began, he soon found himself in command of one of the first panzer divisions established, while General Oswald Lutz took command of the overall development of combined-arms, mechanized forces. Guderian worked very closely with Lutz and thus, while not in a position of direct command, he did remain one of the most influential innovators in the army.

Dowding, however, is an interesting case for two reasons, both having to do with his length of tenure at the head of Fighter Command. He assumed that position in 1937 and had to create a brand new system of air defense within a three-year period and then fight the Battle of Britain with the system of air defense that he had created. Thus, he held a position of command over the creation of combat capabilities for a relatively short period of time.

Nevertheless, it is worth noting that Dowding had been the head of the RAF's research and development programs from 1931 through to the time he took over Fighter Command. In that position he set the specifications for the Spitfire as well as the Hurricane and in 1935 provided the funding for the first experiments with radar—a key component in the system that defeated the Germans in the Battle of Britain.[30]

Virtually all of the successful innovations in the interwar period of the 1920s and 1930s appear to have been the result of sustained periods of evolutionary rather than revolutionary change. The results may have appeared to have been revolutionary to those on the losing end. For example, virtually all French and British officers in 1940 thought the Germans had developed revolutionary capabilities. Few German officers would have agreed, and the few that did for very different reasons.[31] Yet, as Dowding's contribution during his tenure as the head of the RAF's research and development establishment suggests, even Fighter Command's development was as much an evolutionary process as a revolutionary one.[32]

A major factor in the success of top-down leadership throughout this period was a willingness to evaluate honestly the experiments and exercises that were conducted to test new ideas and concepts.[33] This required a

[30] For Dowding's extraordinary ability to work with scientists, see Alan Beyerchen, "From Radio to Radar: Interwar Military Adaptation to Technological Change in Germany, the United Kingdom, and the United States," in Murray and Millett, *Military Innovation in the Interwar Period*, chpt. 7.

[31] General Erich Marcks, one of the most sophisticated officers in the German Army, thought so but only because the *Wehrmacht* had rediscovered the revolutionary enthusiasm of the French Revolution—in other words, Nazi ideology had provided the margin of victory on the battlefield. Marcks's remarks are quoted in Knox and Murray, *The Dynamics of Military*, pp. 155–156

[32] And one should note that in creating an air defense system, Dowding was very much building on the British success in 1918 in creating an air defense system, which only lacked radar but which proved effective to bring the German strategic bombing campaign of that year to a halt. I am indebted to Professor Keith Ferris of the University of Calgary for this point.

[33] On the importance of experimentation to the processes on innovation, see Williamson Murray, *Experimental Units: The Historical Record*, IDA Paper

willingness in senior levels not only to support innovative work but to ensure that the results of experiments and exercises were widely circulated throughout their military organizations.

After the first tests of mobilized units in the Harz mountains, the commander-in-chief of the German Army, General Hans von Seeckt commented in his covering letter on a lessons learned analysis of the experiment that "…we must recognize that mobility is an important substitute for our weak military power."[34] Thus, feedback loops and honest and rigorous testing and experimentation provided a means to adapt doctrine and tactical and operational concepts to the potential of new forms of warfare.

Yet top-down military leadership could be disastrous when it deliberately prevented the creation of feedback loops and where the aim of experimentation and exercises was to validate the concepts and beliefs of senior commanders.[35] The French Army had a particularly bad record in this regard. General Maurice Gamelin, the army's last commander in the interwar period (and its leader in the disaster of 1940), issued a command in 1936 that all articles and books be approved by the High Command before publication. As one officer recalled in his postwar analysis of the defeat: "Everybody got the message, and a profound silence reigned until the awakening of 1940."[36]

P-3684 (Alexandria, VA: Institute for Defense Analyses, May 2002).

[34] Reichswehrministerium, Chef der Heeresleitung, Betr: "Harzübung, 8.1.22," National Archives and Records Service microfilm of captured German records T-70/65/000622.

[35] Robert Doughty's *Seeds of Disaster, French Army Doctrine in the Interwar Years* provides a brilliant analysis of the flaws in French doctrine. (Hamden, CT: Archon Books, 1986)

[36] André Beaufre, *1940, The Fall of France* (New York [n. p.] 1968), p. 47.

Slide 9. Military Culture: The Most Important Enabler

Military Culture: The Most Important Enabler

- Hans von Seeckt and renewal of German Army
  – Downsizing of officer corps
  – Creation of 57 committees to learn lessons of last war
  – Beck and Fritsch and writing of *Die Truppenführung*
- US Navy and creation of carrier war
  – Admiral Sims and Naval War College
  – Tactical and technological experimentation
  – Fleet exercises in twenties and thirties
  – Development of underway fleet replenishment concept
  – Honest experimentation and exercises crucial to development of new concepts and capabilities

9

Of all the major contributors to successful innovation during the 1920s and 1930s, the most important was the organizational culture of the institutions themselves. No organization showed this more clearly than the German Army. General Hans von Seeckt confronted the problem of downsizing the German Army from nearly 20,000 officers in 1919 to the 5,000 allowed by the provisions of the Treaty of Versailles.[37] While most European armies favored a number of different constituencies within their officer corps in postwar downsizing efforts, Seeckt placed the Great General Staff over all the other constituencies, including highly decorated combat veterans. The result was that the General Staff's culture—one that emphasized the serious study of the profession of arms, including

military history, and demanded that its members pass through a rigorous process of selection that included their intellectual abilities—now came to dominate the German Army throughout the entire interwar period. Most German "muddy boots" soldiers, like Erwin Rommel, who was never a member of the General Staff, possessed the same high regard for the intellectual side of the military profession as general staff officers. Rommel not only read books, he wrote them.[38]

Almost concurrently with the dislocations caused by this massive downsizing of the German Army, Seeckt established no less than fifty-seven different committees,

[37] For the most recent examination of Seeckt's contribution, see James Corum, *The Roots of Blitzkrieg, Hans von Seeckt and German Military Reform* (Lawrence, KS: University Press of Kansas, 1992).

[38] Rommel's *Infantry Attacks*, an account of his experiences in the First World War, remains one of the great classics of military history. For a brilliant account of Rommel as both a thinking soldier and a superb practioneer of the operational art, see David Fraser, *Knight's Cross, A Life of Field Marshal Erwin Rommel* (New York: Harper Collins, 1993).

chaired by some of the army's most senior and experienced officers, to examine the lessons of the last war and incorporate those lessons into the army's doctrine and preparations for the next war. His feelings about the importance of studying the last war were suggested in his directive: "It is absolutely necessary to of the war in a broad light and collect this experience while the impressions won on the battlefield are still fresh and a major proportion of the experienced officers are still in leading positions." Seeckt made clear his expectations in a directive to the various committees. They were to produce short, concise studies on the newly gained experiences of the war and consider the following points:

> [a) What new situations arose in the war that had not been considered before the war?

> b) How effective were our prewar views in dealing with the above situations?

> c) What new guidelines have been developed from the use of new weaponry in the war?

> d) Which new problems put forward by the war have not yet found a solution?[39]

Thus, the basis of the German Army's initial examination was an honest, rigorous, and thorough examination of what had actually happened on the battlefields of the First World War. This culture of ruthless self examination was to be a hallmark of the German Army's examination of the innumerable exercises and experiments that it carried out throughout the interwar period. Even when the German Army seem-

ingly had performed in an outstanding fashion, such as its victory over the Polish Army in 1939, it examined its performance with an eye to what had actually happened rather than what the generals might have wished to have happened.[40]

The processes of turning lessons-learned analysis into viable, intelligent doctrine was one of the marks of the successful innovation that led to the creation of the German *Blitzkrieg* that conquered much of Europe in the early 1940s. One mark of that process was the involvement of senior officers deep in the processes of transformation. For example, Generals Werner von Fritsch and Ludwig Beck actually sat down in 1932 and rewrote the army's basic doctrinal manual in a form that would guide the entire process of rearmament as well as the conduct of operations in World War II by German ground forces. That effort, entitled *Die Truppenführung*, represented the finest combat doctrinal manual ever written. Significantly, as an indicator of their importance within the German army, Fritsch was soon to be named the army's commander-in-chief, while Beck was soon to become the chief of the General Staff.

But the Germans were not the only successful innovators in the interwar period. In fact, the US Navy and Marine Corps innovated across a wider spectrum of changes. And in both cases, the two services were breaking with the revealed wisdom of what the future of naval war would be. In the

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[39]   Corum, *The Roots of Blitzkrieg*, pp. 37–38.

[40]   For how this examination of battlefield performance in Poland was carried out and then used to improve the army's future performance, see Williamson Murray, "The German Response to Victory in Poland: A Case Study in Professionalism," *Armed Forces and Society*, Winter 1981.

case of the Navy, the general opinion was that the battleship would remain the dominant weapon of naval war. Nevertheless, by 1941 the US Navy had developed carrier capabilities that allowed its forces to turn the Japanese tide in the Pacific despite the loss of virtually the entire battle fleet. In the case of the Marines in efforts to develop amphibious doctrine and capabilities, they were swimming against a tide of opinion among the rest of the world's military which believed that Gallipoli had proven that opposed amphibious landings were an impossibility in the modern era.[41] The culture of both of these military organizations underlines a willingness to develop and experiment with new concepts in an honest and rigorous fashion.

In the case of US carrier innovation, the President of the Naval War College, Admiral William Sims, set in motion war games that established that air power off of carriers should be thought of in terms of "pulses" rather than "streams," which is how Navy's thought of gunfire.[42] Significantly, Sims and the gamers at the Naval War College came to this conclusion before the Navy possessed a single carrier.

This crucial insight then led to the development of a number of tactical and technical innovations such as arresting hooks, crash barriers, and deck parks, which allowed the US Navy to increase the number of aircraft on each carrier. By the early 1930s, the *Lexington* and *Saratoga* were carrying over five times the number of aircraft as carriers in the Royal Navy.

This culture of developing ideas and concepts at the Naval War College in Newport, Rhode Island, and then testing them rigorously in the annual fleet exercises was to be a mark of US Navy innovation throughout the interwar period. In some cases, such as at sea replenishment, the Navy did not have the resources to develop the concept, but the idea was there, ready and waiting, when the war broke out.

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[41] In 1938 Admiral Andrew Cunningham, then Deputy Chief of Naval Staff reported that the Admiralty "at the present time could not visualize any particular [amphibious] operation taking place and they were, therefore, not prepared to devote any considerable sum of money to equipment for [such] training." PRO CAB 54/2, DCOS/30th Meeting, 15.11.38., DCOS Sub-Committee, p. 4. For further examination of such opposition in Britain, see Murray, *The Change in the European Balance of Power*, p. 89.

[42] Hone, Friedman, and Mandeles, *American and British Carrier Development*, p. 34.

Slide 10. Military Culture: The Most Important Enabler (*continued*)

Military Culture: The Most Important
Enabler (Ctd)

- US Marine Corps
    - Lejeune-Ellis Efforts
    - The Schools at Quantico
    - Fleet exercises in the late 1930s
    - Tarawa
- Crucial importance of PME to processes of successful innovation
    - German General Staff System
    - Equally heavy emphasis in US
    - Identification of military profession with distinct body of knowledge
    - Fast track officers assigned to faculties

10

Similarly, the culture of the US Marine Corps led to the development of ideas and concepts in the Schools at Quantico and then to the testing of those ideas and concepts in annual fleet exercises.[43] General John Lejeune started off the process during his tenure as Commandant of the Marine Corps during the 1920s. Particularly noteworthy was Lejeune's willingness to use relatively junior officers, like Pete Ellis, to forward the processes of innovation and concept development. The culture of the Marine Corps during this period was such that in 1931 it closed down academics at The Schools in Quantico for a five-month period and used the officers to write the initial manual of amphibious operations that formed the doctrine for such opera-

tions throughout World War II in both the Pacific and European Theater of operations.

Perhaps the strongest indicator of the health of military culture was the attitude towards professional military education. For example, entrance into the German Army's General Staff could only be gained by the passing of an entrance examination that eliminated over 95 percent of those who presented themselves for the exam. Even then nearly half of the students at the *Kriegsakademie* flunked out over the two-year course of study.[44]

Interestingly, the US military took professional military education as seriously as did the Germans. One of the surest indicators of institutional support for professional military education was the willingness to

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[43] For those processes see Allan R. Millett, "Assault from the Sea: The Development of Amphibious Warfare Between the Wars—The American, British and Japanese Experiences," in Murray and Millett, *Military Innovation in the Interwar Period*, chpt. 2.

[44] For an examination of the German professional military educational system during the 1920s and early 1930s, see David Spires, I*mage and Reality, The Making of the German Officer, 1921–1933* (Westport, CT: Greenwood Press, 1984).

place the best officers on the faculties of such institutions. In the case of the Naval War College, the future Admiral Raymond Spruance served not one but two tours on the faculty, and then when the Second World War was over, returned to Newport to serve as President of the war college. In the last years before the entrance of the United States into the war, of seven faculty members at the US Army's War College in the 1939–1940 academic year, one (Colonel W. H. Simpson) would rise to Command Ninth Army in the European Theater of Operations, while another (Major J. Lawton Collins) would rise to corps command during the war and later become chief of staff of the army.

Slide 11. Military Culture: The Most Important Enabler (*continued*)

Military Culture: The Most Important Enabler (Ctd)

- French army's culture entirely top-down
    - Senior leadership decreed
    - No room for debate
        - Gamelin's pronouncement of 1937
- British Army consistently undervalued professional military education
    - Contempt for officers who studied the profession
    - Too serious approach to officership regarded as bad form
        - Golf, tennis, and polo what officers pursued
- The Bottom Line:*The military profession is not only the most demanding physically, it is also the most demanding intellectually of all the professions*

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Obviously, not all the military organizations that took professional military education seriously performed well in the next war. The French Amy is, indeed, a case in point. It took attendance at its schools, particularly the War College, very seriously indeed. The problem was that the school's curriculum was dictated by the High Command; and every effort was made to ensure uniformity of thought—as Gamelin's diktat to the officer corps that no article could be published by an officer without the High Command's permission underlines.[45] The

War College also studied the battles of 1918 very closely, but only those battles that supported its basic philosophy of operations, the methodical battle.

Those military institutions that did not take professional military education seriously had major problems in adapting to the real conditions of combat, in some cases disastrously so. The Italians never took the business of preparing their officer corps seriously for war. As General Ubaldo Soddu remarked about the military profession from the Italian point of view: "When you have a fine plate of pasta guaranteed for life, and a little music, you don't need anything more." Soddu would spend his evenings in fall 1940, when he was in

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[45] Robert Doughty notes the following about the French educational system: "Within France's concept of total war, the methodical, deadly battle survived. No new method of counter-evidence could overturn or replace that concept. Vacillation on the nature of future warfare, which had been common in French thought in the early 1930s, subsided in the late 1930s. In the opinion of many in the military, French doctrine had been corroborated by the Spanish Civil War. In addition, their careful study of French experience in World War I reassured them of the cor-

rectness of their approach, and their analysis of other wars seemed to demonstrate support for their methods, rather than to refute them or cast them in doubt. Very few members of the French military questioned the carefully and logically constructed doctrine." Doughty, *The Seeds of Disaster*, pp. 89–90.

command of the collapsing front in Albania, composing sound track for Italian movies.[46] Military professionalism demands serious attention in the field as well as in the classroom. The Italian military provided neither.

The British Army provides an interesting contrast that suggests how crucial a serious professional attitude and culture is to providing for military effectiveness.[47] As the British military historian Sir Michael Howard has suggested:, "[the] evidence is strong that the army was still as firmly geared to the pace and perspective of regimental soldiering as it had been before 1914; that too many of its members looked on soldiering as an agreeable and honorable profession rather than as a serious profession demanding no less intellectual dedication than that of the doctor, the lawyer or the engineer."[48] One of the leading tank pioneers in the army, Major General Percy Hobart, noted

in a letter to his wife in 1938 as he was trying to form a mechanized division in 1939 in Egypt the following about the professionalism of his officers:

> I had the cavalry CO's in and laid my cards on the table. They are such nice chaps, socially. But they're so conservative of their spurs and swords and regimental tradition, etc., and so certain that the good old Upteenth will be all right…, so easily satisfied with an excuse if things aren't right, so prone to blame the machine or machinery. And unless someone upsets all their polo, etc., for which they have paid heavily—it's so hard to get anything more into them or any more work out of them. Three days a week they come in six miles to Gezirah Club for polo. At 5 pm it's getting dark: they are sweaty and tired. Not fit for much and most of them full up of socials in Cairo.[49]

The bottom line in regards to military culture is that *the military profession is not only the most demanding of all the professions physically, it is also the most demanding intellectually.* Those military institutions that prepare their officers for the intellectual as well as the physical challenges of war had some chance of innovating successfully in peacetime and adapting successfully in war to the actual conditions they confronted.

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[46] MacGregor Knox, *Mussolini Unleashed, 1939–1941, Politics and Strategy in Fascist Italy's Last War* (Cambridge: Cambridge University Press, 1982), p. 57. The performance of Italian military institutions had nothing to do with the bravery of the Italian soldiers themselves: over 600,000 died in the Alpine passes during World War I; nearly 300,000 died in combat during World War II. The point is that with a completely unprofessional officer corps, those soldiers had no chance on the field of battle.

[47] For the most thorough examination of the British Army's flawed culture, see Brian Bond, *British Military Policy Between the Two World Wars* (Oxford: Oxford University Press, 1980). See also Brian Bond and Williamson Murray, "British Military Effectiveness," in Millett and Murray, *Military Effectiveness*, vol. 2, *The Interwar Period*, chpt. 4.

[48] Michael Howard, "The Liddell Hart Memoirs," *Journal of the Royal United Services*, February 1966, p. 61

[49] Quoted in Murray, "Armored Warfare, The British French and German Experiences," in Murray and Millett, *Military Innovation in the Interwar Period*, p. 23.

Slide 12. The Problem with This Period as a Model

> ## The Problem with This Period as a Model
>
> - Occurred after WWI had framed the right questions
> - Relatively short period
>   - Most senior leaders and innovators had had combat experience
> - Technological change in external society relatively steady – few new paths
> - Failures in last war provided impetus for change in many military institutions
> - Future opponents relatively clearly delineated
>
> 12

The period of the 1920s and 1930s is certainly suggestive of the complexities involved in the processes of transformation and change. It may, however, not represent the clearest paradigm for the kinds of challenges that the Department of Defense will confront in the coming century. It occurred immediately after a great world war had framed virtually all of the major problems and possibilities that World War II would feature.[50] Moreover, this period was relatively short in duration, barely spanning two decades. Thus, all of the senior leaders and some of the middle level leadership in World War II had had some combat experience, when the new conflict broke out.

But beyond their combat experience, most military leaders recognized that the military institutions of the last was had largely failed in their adaptation to the conditions of war.[51]

Finally, one of the striking features of this period is that while the pace of technological change was considerable, there was little that was revolutionary in terms of technological change in either the civilian societies or in the military. Thus, the problems in adapting to technological change, with the possible exception of radar, proved to be more manageable than they had been during the previous interwar period (1872–1914).[52]

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[50] Of all the revolutions in military affairs that would emerge in the early years of World War II, only airborne operations had not been employed in the last conflict, although some military leaders had begun to think about the possibilities in 1916.

[51] The foremost example of a military leader who had been convinced that the patterns of the last war must not be repeated was the future British Field Marshal Bernard Law Montgomery. Where Field Marshal Douglas Haig had been profligate with the lives of his soldiers in his conduct of operations, Montgomery's great popularity with his troops lay in their sense that he was always going to be careful with their lives.

[52] The British success in using radar largely lay, as suggested above, in the fact that it was immediately incorporated into a system of air defense. And the fact that the Germans never realized that it was incorporated into a system explains why they only bombed the British radar stations during the early days of the Battle of Britain. The Germans themselves would not possess a true air defense system until after Bomber Command's devastating four raids on the city of Hamburg in July 1943 forced them to create one.

Slide 13. A New Paradigm?

The interwar period that the United States and its military embarked on in 1992 is already beginning to look quite unlike the period from 1920 through 1939. At present there are no major challengers, even in a regional sense, on the horizon. Thus, it is unlikely that the military forces of the United States will be engaged in a major conflict for a number of decades.[53] To exacerbate the difficulties presented by the lack of a major threat, time has already washed combat experience out of the US military to a great extent. Only a few of the most senior officers still possess combat experience from the Vietnam War. More-over, one could question how useful combat experience in the Gulf War of 1991 might prove in the coming decade to thinking about the problems and challenges of military threats in the twenty-first century.

But the greatest point of difference between the interwar period of the 1920s and 1930s and the current age lies in the fact that we are presently living in a period of greater technological change that is transforming the very basis of human society. What occurred in the 1920s and 1930s was a period largely characterized by *evolutionary change*. We today are facing *revolutionary change*. While those who have been declaiming the disappearance of government are clearly wrong, the effect of technology on the lives and methods of doing business as well as the implications of those changes are so enormous as to suggest that we are living in as revolutionary a period of social transformation as the period immediately before the First World War.

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[53]   As this is being written (September 2001), it is entirely possible that the military forces of the United States will be engaged in major operations against the Taliban and the terrorists of Bin Laden. Nevertheless, military operations against such an opponent, no matter how difficult, will look much more like the punitive operations conducted by the British Army against the enemies of the Empire than a great conflict.

Slide 14. The Interwar Period 1872–1914 May Be More Relevant to Our Period

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The Interwar Period 1872–1914 May Be More Relevant to Our Period

- The Franco-Prussian War provided little guidance as to where war was going
- Massive wave of technological changes altered the framework of military and civilian worlds
  - Electrification/telephone
  - Internal combustion engine
  - Chemical revolution
  - Seaborne transportation
- Cumulative impact of changes were truly *revolutionary* – major break with the past

14

In many ways the period between the Franco-Prussian War (1870–1871) and the outbreak of the First World War in 1914 may have greater similarity to the present emerging interwar period. First, the Franco-Prussian war suggested little about what the next war would be like.[54] The decisiveness of the Prussian military victory largely obscured the fact that Prussia's success owed more to the brilliant strategic and political policies of the Prussian statesman, Otto von Bismarck, than to the performance of Moltke's armies.[55] Unfortunately, it was to the battle-fields of 1870–1871 and the stunning victories of the Prussian Army that European military organizations looked.[56] With a war that was less than suggestive about the direction in which conflict was moving, European military organizations were already on the way towards getting the next war wrong before this interwar period had scarcely begun.

A second factor that influenced how European military institutions prepared for war had to do with the massive technological changes taking place in European and American societies. For the first time, one can talk of a revolutionary change in how

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[54] The Franco-Prussian War resulted in a decisive victory by the Germano-Prussian military forces. It was won at relatively little cost. Modern technology seemed to have increased the pace of military operations. And the French collapse into a civil war suggested to many observers that modern societies could not bare the pressures of a major war. The Europeans, with the exception of a few British commentators, largely ignored the lessons of the American Civil War. For the best study of the Franco-Prussian War, see Michael Howard, *The Franco-Prussian War, The German Invasion of France, 1870–1871* (New York: MacMillan, 1961).

[55] Moreover, the decisiveness of the Prussian military victories owed much to the abysmal military incompetence of the French commanders at the beginning of the war.

[56] The similarities between the decisiveness of the Franco-Prussian War and the decisiveness of the Gulf War at the start of interwar periods is indeed worrisome, particularly for their effect on military institutions.

man related to his environment. Electrification brought light to the night; the telephone began to change the fundamental fashion in which people communicated; chemistry transformed virtually every industry that it touched, including agriculture. The internal combustion engine transformed age-old methods of moving goods and people; it also allowed man for the first time to reach into the skies with powered flight; and for the first time one could talk about medicine as making some real contribution to the health of its patients.

These were, of course, the outward manifestation of revolutionary transformation that altered the basis of human society, which since time immemorial had poised on the brink of starvation. In the end, these changes were to make human societies in the emerging industrial world far more flexible and adaptable; as both World War I and World War II were to underline, human societies, as organized by the industrialized nation-state, were capable of bearing almost any burden and paying almost any price.[57]

One should also note the sustained period of peace through which Europe's military institutions passed during this period. The British did have a number of small campaigns to wage, but only the Boer War offered some insights as to what a future war might look like.[58] The most reasonable of

those insights, the importance of aimed infantry fire, contributed to the enormous death toll the British Expeditionary Force extracted from the Germans in 1914, particularly at the Battle of Langemark, but it provided few tactical insights. For the Russians, the Russo-Japanese War of 1904–1905 might have suggested more except for the fact that their military institutions had to focus on putting their houses in order after the revolutionary turmoil of 1905.

For most of Europe's military institutions the long period of peace largely involved great maneuvers (exercises) that possessed virtually no realism. The German annual maneuvers actually concluded each year with a great cavalry charge led by the Kaiser, at least until the younger Moltke put an end to such nonsense after his appointment as chief of the General Staff in 1907. The very climate and length of this interwar period thus contributed to increasingly more unrealistic measures of effectiveness and assumption. The great awakening would eventually come in 1914, but by then it was too late to undo the damage.

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[57] This was a point that military as well as civilian leaders were to get entirely wrong in the period before the outbreak of the First World War.

[58] For the debates in the British Army after the Boer War, see particularly Timothy Travers, *The Killing Ground, the British Army, the Western Front and the Emergence of Modern Warfare, 1900–1918* (London: Allen and Unwin, 1987).

Slide 15. Military Institutions Were Profoundly Affected by the Changes

> ## Military Institutions Were Profoundly Affected by the Changes
>
> - But long period of peace resulted in bureaucratization of military institutions
>   - The "looking good" syndrome
>   - Intellectual laziness
>   - Untested assumptions piled on top of untested assumptions
> - Nevertheless, World War I's lethality was not a surprise to some
>   - Few doubted bullets could kill
>   - But virtually all accepted expert opinion that societies could not bear the burden of a long war
>
> 15

Not surprisingly, military institutions were profoundly affected by the vast changes in society that were taking place around them, but vast technological changes were taking place in the military sphere as well. Machine guns now became available in substantial numbers.[59] Chemistry provided smokeless powder, and even more insidiously high explosives that would make artillery the terrible killer of the First World War battlefield.[60] Recoil mechanisms provided that arm with the means for accurate indirect fire on a sustained basis. Chemistry had the ability to produce artificial nitrates as well as poison gas in substantial quantities. The steel industries of Europe were capable of turning out endless coils of barbed wire, soon to be the nightmare of every military planner on the Western Front.

One of the great myths perpetrated by historians is that all of these technological and scientific changes caught Europe's military by surprise.[61] None of the enormous changes remained unobserved by Europe's serious military observers.[62] The problems that confronted them were, however, enormously complex. The military journals of all the major military powers indicate a serious effort to come to grips with the intractable and uncertain problems that military technology was raising.

By early 1914 the tactical solution of at least fire and maneuver were beginning to emerge.

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[59] The French had stuck their secret weapon, the mitrailleuse, the first machine guns, with the artillery, the commanders of which had no idea of what to do with this new weapon, so they stuck them in the baggage trains, where they played little role in the war.

[60] Nearly two-thirds of the casualties in World War I would be inflicted by artillery shells.

[61] See Sir Michael Howard, "Men Against Fire: The Doctrine of the Offensive in 1914," in *Makers of Modern Strategy* (Princeton, NJ: Princeton University Press, 1986).

[62] For an examination of European military thinking (with an emphasis on the Germans) before the war, see Anthony J. Echevarria, *After Clausewitz, German Military Thinkers Before the Great War* (Lawrence, KS: University Press of Kansas, 2000).

Likewise some artillerymen were grappling with the difficult problems involved with indirect artillery fire. But the difficulties that such officers had in examining these complex problems were exacerbated by the general view of politicians and social scientists at this time. Most of the experts believed the next war had to be short—their assumption was that modern societies were fragile and could not bear the cost either financially or politically of a long war.[63] Such a strategic framework, on one hand, limited the options available to the generals.[64] On the other hand, it prevented them from seeing some of the really nasty tactical implications that a long war might bring in its trail.

Aggravating all of the tactical, operational, and strategic uncertainties that confronted Europe's military organizations was the reality that as the interwar period continued for decades, the officer corps became increasingly self-satisfied bureaucracies, content to polish the brass, participate in the social whirl of regimental balls, jockey for good assignments and commands, and complain about the lack of support from the politicians. This was the larger problem that military institutions confronted. Some military institutions, such as the Royal Navy, had not faced a major opponent or threat since 1814 with the collapse of Napoleon's empire.[65]

Admittedly, military institutions had confronted enormous technological changes beginning at the end of the nineteenth century, which only exacerbated the problem: by focusing on technological changes, even military reformers missed the leadership and tactical problems that were confronting military institutions.[66]

What is clear in the prewar military journals is that ground force officers were beginning to understand the complexities of the tactical problems military organizations would confront in the coming conflict. However, the larger culture of the officer corps paid little attention to the resulting debates and discussions in the professional journals.[67] Admittedly, we are dealing still in the early twentieth century with the emergence of the military profession as a serious profession—

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[63] They were certainly wrong but the Russian experience in the Russo-Japanese War certainly suggested that such assumptions might well be correct when revolution and financial collapse occurred within a year, forcing the Russians out of the war.

[64] It certainly explains why so many of Europe's generals thought only in terms of the offensive; a defensive strategy offered no hope of a short war.

[65] Andrew Gordon in his book on the Royal Navy during this period recounts the slow, degenerative decline of the Royal Navy from Nelson's warfight-

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ing organization to an organization unprepared for combat and possessing a culture that made its senior officers incapable of showing any initiative in the face of an opponent. The results showed all too clearly from the beginning of the war with the escape of the *Breslau* and *Goeben* to Constantinople through to the failure of the Grand Fleet to destroy the High Seas Fleet at Jutland despite a number of opportunities. See Andrew Gordon, *The Rules of the Game, The Royal Navy and the Failure at Jutland* (London: John Murray, 1999).

[66] Admiral Sir John "Jackie" Fisher radically altered not only the strategic framework but the technological focus of the Royal Navy when he became First Sea Lord. However, Fisher did not have time to grapple with the navy's cultural and leadership problems—partially because even Fisher could not grasp in peacetime how extensive those problems would prove to be in the coming war.

[67] Echevarria in *After Clausewitz* presents a compelling case for the failure to transfer the thinking in the journals to the general culture of military organizations, even that of the German Army.

one that required as serious study as the professions of medicine and the law.

The disparity between those who did prepare themselves and their units for war and those that did not proved at times compelling in the first clash of arms. A German attack in East Prussia during daylight and over open ground suggests what was possible. At Gerdauen on 9 September 1914, the 43rd Infantry Brigade, commanded by an officer who coordinated his attack with artillery and used open-order, fire and maneuver to attack Russian positions, suffered only 2 percent casualties. In stark contrasts, one of his reserve companies that attacked without regard to the changes that had taken place on the battlefield over the previous fifty years suffered over 50 percent casualties.[68]

Unfortunately, the commander of the latter unit was far more typical of the officers who went to war in 1914 that the former. What is clear is that those officers who had not prepared themselves intellectually before the war were incapable of adapting to the actual conditions of war that European armies confronted from 1914 through to 1918. The result almost destroyed European civilization.

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[68]   Echevarria, *After Clausewitz,* p. 217.

Slide 16. The Catastrophe of WWI Magnified by a Number of Factors

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The Catastrophe of WWI Magnified by a Number of Factors

- What worked theoretically would not necessarily work when the number of targets expanded exponentially
- WWI was a learning experience on an incalculable scale from the opening shot
  - The opposing sides were complex adaptive systems
- Most commanders and staff officers had been mentally lazy and sloppy in the prewar period
  - Even the Germans had not taken the intellectual side of the profession of arms seriously
- Bureaucratization of peacetime military procedures as well as the innovations necessary to adapt to peacetime technological change
  - The Royal Navy

16

The flawed military cultures that entered World War I confronted a number of complex and intractable problems. First of all, what had worked in a relatively small arena in prewar experimentation did not necessarily transfer into the larger arena of war. For example, the principles of indirect fire were generally understood by most forward thinking artillerymen.[69] However, those principles, developed by the use of a relatively few guns, proved difficult to translate onto battlefields where the number of targets multiplied exponentially as the war continued. Moreover, the application of low-tech solutions, such as barbed wire, presented armies with difficulties that took years rather than months to solve.

Thus, one might best think of World War I as a learning experience for those who directed and fought in it on an incalculable scale. There were no simple, obvious solutions. Moreover, the opposing sides were complex adaptive systems that transformed themselves as the war continued.[70] As a result, military organizations constantly confronted new tactical problems as the enemy adapted and changed under the pressures of war.

Military leaders who, for the most part, had not prepared for the mental challenges they would confront only exacerbated the difficulties in adapting to the new and constantly changing battlefields that the war presented.

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[69] Although not by all. See Jonathan Basiley, "The Revolution in Military Affairs in Artillery," in Knox and Murray, *The Dynamics of Military Revolution*, chpt. 7.

[70] The much maligned Nivelle Offensive of spring 1917 failed, not because General Nivelle was a fool as so many historians suggest, but rather because the Germans had entirely changed the basis of their defensive system from a linear system to one that emphasized defense in depth. For the German transformation, see Timothy Lupfer, *The Dynamics of Doctrine* (Fort Leavenworth, KS: Combat Studies Institute, 1983).

Slide 17. Conclusion

Conclusion

- The lessons of 1872-1914 period similar to those of 1920-1939 period, **but in a sustained period of peace**
  - Even more difficult to focus on warfighting skills
  - "Looking good" increasingly becomes the standard of judgment
  - Becomes ever more difficult to evaluate or challenge basic assumptions about future war
  - Primary focus must be on long-term *education* of officer corps
  - If the organization does not work **hard** at honest, effective innovation in peacetime, it will not be able to adapt to the actual conditions of war

17

To a considerable extent, the interwar period between 1872 and 1914 confirms the problems that arose in the 1920–1939 period. But it also suggests that the problems that occurred after a sustained period of peace lasting a number of decades will prove to be even more intractable and difficult to solve.

It also suggests that a sustained period of peace will increase the pressures to bureaucratize and systematize the patterns of peacetime, and ignore the messy and uncertain paths of experimentation and innovations that challenge the basic assumptions of military institutions.

What the period before World War I also suggests is that professional military education becomes even more important. Thus, the primary focus of military institutions must be on the long-term education of the officer corps. That professional military education must emphasize the creation of an intellectually focused, adaptable, and flexible officer corps in which seniors and junior officer carry out discourses that prepare them to adapt to new and unforeseen circumstances.

The bottom line is that if a military organization does not work hard at honest, effective innovation in peacetime, it will not be able to adapt to the actual conditions of war.

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14. ABSTRACT

This paper contains two lectures on military innovation and transformation. The first lecture discusses the drivers of transformation and innovation in the US military between the two World Wars. The lessons drawn here are still applicable to current efforts to transform the American military. Moreover, intellectual effort is always needed for successful innovation in peacetime, and that this intellectual effort should be connected to rigorous and honest experimentation. The second paper is based on two major studies undertaken in the 1980s and early 1990s for the Office of Net Assessment. The author takes a broader look at military innovation by examining the patterns of history and the experiences of other military institutions. He identifies institutional qualities, culture, and organizational dynamics that contribute to military effectiveness and successful innovation in periods of rapid technological change. Focusing on the timeframes of 1920–1939 and 1872–1914, the author argues that the challenges of the earlier period (1872–1914) may be more relevant to our own time.

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